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Punch for producing holes in the wall of hollow parts subjected to the action of internal high pressure

The invention relates to the design of punches for producing holes in the walls of hollow parts, the part being subjected to the action of high pressure in the interior by a medium during the punching.

In particular when producing hollow parts by the internal high pressure forming process, it is normal practice, following the forming and with the part still located in the forming tool, to make holes in the wall.

DE 43 22 063 C2 discloses a method and a device for cutting out a blank from a wall of a hollow body produced according to the internal high pressure forming process. In this case, the blank is cut out directly after the internal high pressure forming by means of a punch acting from outside on the lateral surface of the hollow body. To this end, the driven punch passes through the internal high pressure forming tool. A tool of the generic type is described in DE 199 34 663 A1.

When cutting through the hollow body, a pressure drop in the hollow body inevitably occurs due to the resulting leakage. If a plurality of holes are to be made in the hollow body, the holes must be made exactly simultaneously so that the internal pressure required for satisfactory punching is available during all the punching operations. This simultaneity of the punch drives requires considerable control input and very high pumping capacities or correspondingly large accumulators. Also disadvantageous is the extremely abrupt loading of the hydraulic components.

The object of the invention is to design the punches for use of the generic type in such a way that a drop in the internal high pressure when cutting through the wall of the part is largely avoided.

This object is achieved by a punch design according to the features of patent claim 1. Detailed configurations of the punch are specified in the subclaims.

The punch is designed so as to taper at an angle in the direction of the cutting edge in its region plunging into the part to be punched. As a result, during the cutting, the material in the region of the hole wall is upset in accordance with the tapered outer contour of the punch, and the hole is immediately sealed by the punch. In this way, when making a plurality of holes, the punches can be moved slowly and asynchronously to one another with respect to time. The quality of the holes produced and the process reliability increase considerably as a result. The cost in terms of equipment can be kept correspondingly low, since the tools can be of simpler and more compact design. Thus no expensive measures are required for achieving synchronized sequences, such as tool bridges or electronic path control.

An exemplary embodiment of the invention is shown in the drawing and described in more detail below.

In the drawing:

fig. 1 shows a diagrammatic illustration of a punch before the punching,

fig. 2 shows a diagrammatic illustration of a punch after the punching.

Figure 1 shows, in a partial section, a hollow part 2 which is preferably produced by the internal high pressure forming process and is still subjected to the action of internal high pressure and which bears with its outer contour against the inner wall of an internal high pressure forming tool 4. In the internal high pressure forming tool 4, a punch 1 is arranged in such a way as to be movable in the arrow direction preferably by means of a hydraulic drive (not shown). In its region plunging into the part 2, the punch 1 is designed to taper conically toward the cutting edge 3. The angle of taper is in this case greater than 0° and is at most 30°, but preferably 1° to 3°. In this case, the cutting edge 3 of the punch 1 is set back slightly relative to the mold inner wall of the internal high pressure forming tool 4.

To make the hole, the punch 1 is moved in the direction of the part 2, and the cutting edge 3 cuts through the wall of the part in the process. The conically designed region of the punch 1 upsets the material in the region of the hole wall 5 and the hole is simultaneously sealed by the punch 1. Therefore no drop in the internal high pressure occurs (fig. 2).

Since the internal high pressure is maintained in this way, it is possible, without any problems, to make further holes asynchronously with respect to time using a plurality of punches.